Virginia
Standards of Learning Assessments

Spring 2001 Released Test

(Supplemental Information)

End of Course

Geometry

Property of the Virginia Department of Education

End of Course

Introducing the Virginia Standards of Learning

Geometry

One of the complete test forms from the Spring 2001 Standards of Learning administration is presented in the following pages. The intent of this released test is to provide parents and teachers additional information to accompany the Student Performance Report and/or the Parent Report.

The information accompanying each test question is broken into several components:

Reporting Category: Matches the score report and allows for identification of strengths and weaknesses indicated by student scores.

Standard of Learning: Presents the SOL used in developing the assessment question.

Instruction: Provides information for teachers to use as the SOL is incorporated into instruction.

The answer to each question can be found at the back of the booklet.

Geometry

End of Course

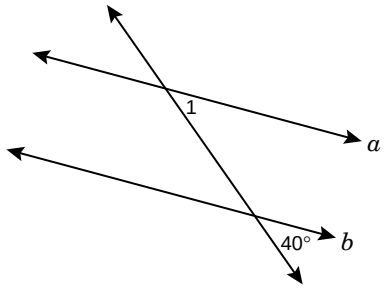
Reporting Category: Lines and Angles

A. Standard of Learning: G.4 The student will use the relationships between angles formed by two lines cut by a transversal to determine if two lines are parallel and verify, using algebraic and coordinate methods as well as deductive proofs.

Builds On: Students begin to study the concept of parallelism in the grade 4 SOL and progress in difficulty of concepts through the eighth grade SOL.

A

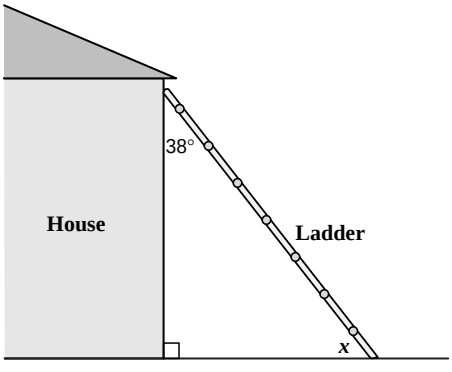
1



If line *a* is parallel to line *b*, what is m∠1?

A 40°
B 50°
C 90°
D 140°

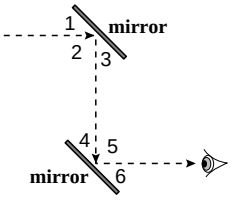
2 **A ladder is leaning against a house at an angle of 38° as shown in the diagram.**



What is the measure of the angle, *x*, between the ladder and the ground?

F 38°
G 42°
H 52°
J 142°

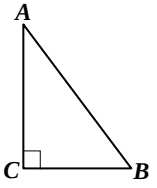
3



This diagram shows how a periscope works. If the two mirrors are parallel and ∠1 ≅ ∠3, what is m∠6 when m∠2 = 90°?

A 30°
B 45°
C 50°
D 60°

4



Triangle *ABC* is a right triangle with the right angle at *C*. Which are possible measures for angle *A* and angle *B*?

F 48° and 50°
G 38° and 32°
H 52° and 38°
J 52° and 128°

Instruction: Provide students an opportunity to analyze a diagram in a problem situation requiring determination of angles formed by parallel lines being cut by a transversal; to solve problems by use of the triangle in equality; and through knowledge of complementary angles, find a missing angle in a right triangle.

Geometry

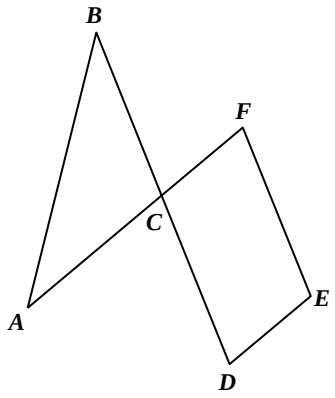
End of Course

A. Standard of Learning: G.3 The student will solve practical problems involving complementary, supplementary, and congruent angles that include vertical angles, angles formed when parallel lines are cut by a transversal, and angles in polygons.

Builds On: Students begin studying angles in the grade 3 SOL and progress in complexity of the relationships studied through grade 8 SOL.

A

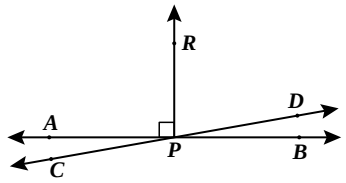
5



Sides $\overline{BC}$ and $\overline{AC}$ of ΔABC are extended to form 2 sides of parallelogram $CDEF$. $\angle CAB$ and $\angle CBA$ each measure 36°. What is the measure of $\angle CFE$?

A 36°
B 54°
C 72°
D 108°

6 **Lines AB and CD intersect at P. $\overrightarrow{PR}$ is perpendicular to $\overleftrightarrow{AB}$, and m $\angle APD = 170°$.**



What is the measure $\angle DPB$?

F 10°
G 20°
H 30°
J 40°

Instruction: Provide students an opportunity to analyze a diagram in a problem situation requiring the application of knowledge of complementary, supplementary, and vertical angles; and to determine measurements of angles formed in a parallelogram.

Geometry

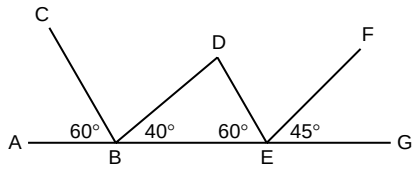
End of Course

A. Standard of Learning: G.3 The student will solve practical problems involving complementary, supplementary, and congruent angles that include vertical angles, angles formed when parallel lines are cut by a transversal, and angles in polygons.

Builds On: Students begin studying angles in the grade 3 SOL and progress in complexity of the relationships studied through grade 8 SOL.

A

7



Using the information on the diagram, which is true?

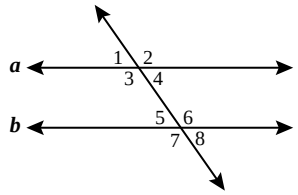
A $\overline{BD} \parallel \overline{EF}$

B $\overline{BD} \parallel \overline{DE}$

C $\overline{CB} \parallel \overline{BD}$

D $\overline{CB} \parallel \overline{DE}$

8



Line *a* is parallel to line *b* if —

F $m\angle 4 = m\angle 2$

G $m\angle 3 = m\angle 5$

H $m\angle 4 = m\angle 5$

J $m\angle 3 = m\angle 2$

Instruction: Provide students an opportunity to analyze a diagram in a problem situation requiring knowledge of angle measures formed by parallel lines being cut by a transversal.

Geometry

End of Course

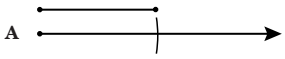
A. Standard of Learning: G.11 The student will construct, using a compass and straightedge, a line segment congruent to a given line segment, the bisector of a line segment, a perpendicular to a given line from a point not on the line, a perpendicular to a given line at a point on the line, the bisector of a given angle, and an angle congruent to a given angle.

Builds On: Students begin drawing representations of figures in grade 3 SOL and move into constructions in the grades 6, 7, and 8 SOL.

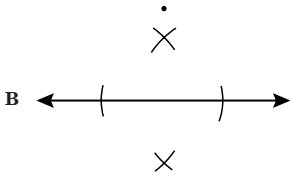
A

9 Which drawing shows the arcs for a construction of a perpendicular to a line from a point not on the line?

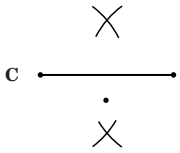
A



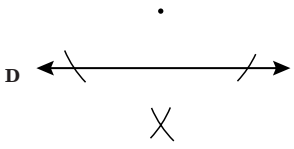
B



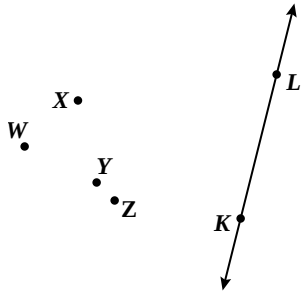
C



D



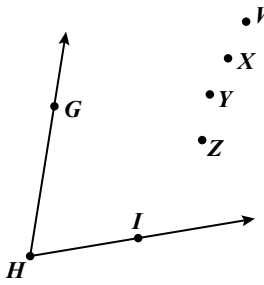
10 Use your compass and straightedge to construct a line that is perpendicular to $\overleftrightarrow{KL}$ and passes through point *K*.



Which point lies on this perpendicular?

F *W*
G *X*
H *Y*
J *Z*

11 Use your compass and straightedge to construct the bisector of $\angle GHI$.



Which point lies on this bisector?

A *W*
B *X*
C *Y*
D *Z*

Instruction: Provide students an opportunity to identify what construction is modeled in a diagram; and to do a construction and determine through which points a construction passes.

Geometry

End of Course

Reporting Category: Triangles and Logic

A. Standard of Learning: G.1.a The student will construct and judge the validity of a logical argument consisting of a set of premises and a conclusion. This will include identifying the converse, inverse, and contrapositive of a conditional statement.

Builds On: Students begin to use reasoning skills in Kindergarten SOL. The complexity of the situations and the need for justification increase through the grade 8 SOL.

A

12 Let *a* represent "*x* is an odd number." Let *b* represent "*x* is a multiple of 3."

When *x* is 7, which of the following is true?

F $a \wedge b$
G $a \wedge \sim b$
H $\sim a \wedge b$
J $\sim a \wedge \sim b$

Instruction: Provide students an opportunity to determine a valid argument using symbols and logical operators.

B. Standard of Learning: G.1.c The student will construct and judge the validity of a logical argument consisting of a set of premises and a conclusion. This will include diagramming arguments involving quantifiers (all, no, none, some), using Venn diagrams.

Builds On: Students begin to use reasoning skills in Kindergarten SOL. The complexity of the situations and the need for justification increase through the grade 8 SOL.

B

13 Which conclusion logically follows the true statements?

"If negotiations fail, the baseball strike will not end."

"If the baseball strike does not end, the World Series will not be played."

A If the baseball strike ends, the World Series will be played.
B If negotiations do not fail, the baseball strike will not end.
C If negotiations fail, the World Series will not be played.
D If negotiations fail, the World Series will be played.

Instruction: Provide students an opportunity to analyze logical statements using both sentences and logical operators.

Geometry

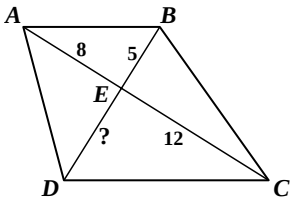
End of Course

A. Standard of Learning: G.5.a The student will investigate and identify congruence and similarity relationships between triangles.

Builds On: Students begin studying the concepts of congruence and similarity in the grade 6 SOL.

A

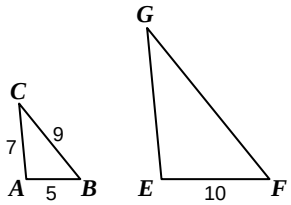
14



In the figure, $AE = 8$, $CE = 12$, and $BE = 5$. What value for the measure of $\overline{DE}$ would make ΔABE similar to ΔCDE?

F 3.3
G 7.5
H 8
J 15

15 **Triangles *ABC* and *EFG* are similar with measurements as shown.**



What is the ratio $\frac{AC}{EG}$?

A $\frac{1}{2}$

B $\frac{5}{7}$

C $\frac{7}{10}$

D $\frac{7}{9}$

Instruction: Provide students an opportunity to identify similar triangles based upon measurements in a diagram and to determine the ratio of sides from dimensions on triangles known to be similar.

Geometry

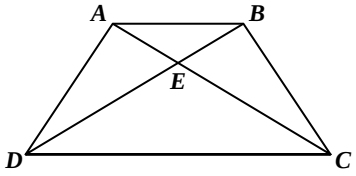
End of Course

A. Standard of Learning: G.5.b The student will prove two triangles are congruent or similar given information in the form of a figure or statement, using algebraic and coordinate as well as deductive proofs.

Builds On: Students begin studying the concepts of congruence and similarity in the grade 6 SOL.

A

16



Given: $\overline{AC} \cong \overline{BD}$
$\overline{AD} \cong \overline{BC}$

Which could be used to prove $\Delta DCA \cong \Delta CDB$**?**

F (SSS) If 3 sides of one triangle are congruent to 3 sides of another triangle, then the triangles are congruent.

G (SAS) If 2 sides and the angle between them in one triangle are congruent to 2 sides and the angle between them in another triangle, then the triangles are congruent.

H (ASA) If 2 angles and the side between them of one triangle are congruent to 2 angles and the side between them of another triangle, then the triangles are congruent.

J (AAS) If 2 angles and a side not between them are congruent to 2 angles and a side not between them of another triangle, then the triangles are congruent.

Instruction: Provide students an opportunity to determine the appropriate postulate or theorem that proves two triangles congruent.

Geometry

End of Course

A. Standard of Learning: G.6 The student, given information concerning the lengths of sides and/or measures of angles, will apply the triangle inequality properties to determine whether a triangle exists and to order sides and angles. These concepts will be considered in the context of practical situations.

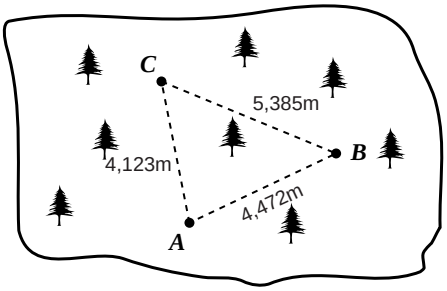
Builds On: Students begin to study triangles in the Kindergarten SOL and progress in complexity through the grade 8 SOL.

A

17 Which of the following could be the lengths of the sides of ΔABC?

A $AB = 12, BC = 15, AC = 2$
B $AB = 9, BC = 15, CA = 4$
C $AB = 150, BC = 100, CA = 50$
D $AB = 10, BC = 8, AC = 12$

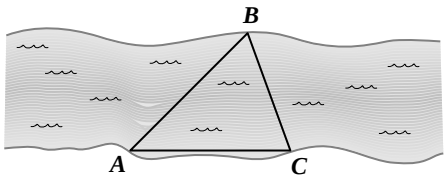
18 Three lookout towers are located at points *A*, *B*, and *C* on the section of a national forest shown in the drawing.



Which of the following statements is true concerning ΔABC formed by the towers?

F m$\angle A$ is greatest.
G m$\angle C$ is greatest.
H m$\angle A$ is least.
J m$\angle C$ is least.

19 On the shores of a river, surveyors marked locations, *A*, *B*, and *C*. The measure of $\angle ACB = 70°$, and the measure of $\angle ABC = 65°$.



Which lists the distances between these locations in order, least to greatest?

A A to B, B to C, A to C
B B to C, A to B, A to C
C B to C, A to C, A to B
D A to C, A to B, B to C

Instruction: Provide students an opportunity to view a graph of a triangle and determine the relative size of the angles; to determine the relationship of sides of a triangle by analyzing a diagram; and to order the distances between points based on a triangular arrangement and angle values.

Geometry

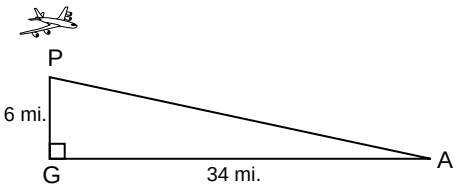
End of Course

A. Standard of Learning: G.7 The student will solve practical problems involving right triangles by using the Pythagorean Theorem and its converse, properties of special right triangles, and right triangle trigonometry. Calculators will be used to solve problems and find decimal approximations for the solutions.

Builds On: Students begin working with right triangles in the grade 5 SOL, and work with the Pythagorean Theorem begins in the grade 8 SOL.

A

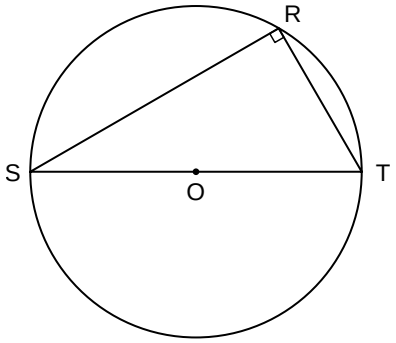
20



An airplane is 34 ground miles from the end of the runway *(GA)* and 6 miles high *(PG)* when it begins its approach to the airport. To the nearest mile, what is the distance *(PA)* from the airplane to the end of the runway?

F 41 mi
G 39 mi
H 37 mi
J 35 mi

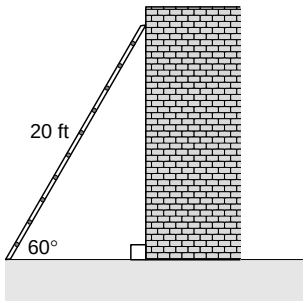
21



In circle *O*, $\angle RST$ formed by chord $\overline{RS}$ and diameter $\overline{ST}$ has a measure of 30°. If the diameter is 12 centimeters, what is the length of chord $\overline{SR}$?

A $12\sqrt{3}$ cm
B $12\sqrt{2}$ cm
C $6\sqrt{3}$ cm
D $6\sqrt{2}$ cm

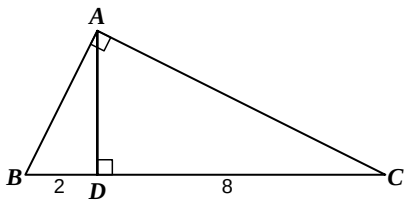
22



A 20-foot ladder leaning against a building makes an angle of 60° with the ground. How far from the base of the building is the foot of the ladder?

F 5 ft
G 8.2 ft
H 10 ft
J 17.3 ft

23



In the figure, ΔABC is a right triangle. *AD* is perpendicular to *BC*, and the measure of *BD* = 2 meters and *DC* = 8 meters. What is the measure of $\overline{AC}$?

A 2.8 m
B 4.5 m
C 8.9 m
D 10.0 m

Instruction: Provide students an opportunity to apply the properties of 30-60-90 right triangles to problems; to solve problems using right triangle trigonometry; and to apply the Pythagorean Theorem.

Geometry

End of Course

Reporting Category: Polygons and Circles

A. Standard of Learning: G.8.a The student will investigate and identify properties of quadrilaterals involving opposite sides and angles, consecutive sides and angles, and diagonals.

Builds On: Students begin studying the characteristics of quadrilaterals in the grade 1 SOL continuing in complexity through the grade 8 SOL.

A

24 Which of the following quadrilaterals could have diagonals that are congruent but do *not* bisect each other?

F A rhombus
G A rectangle
H A parallelogram
J A trapezoid

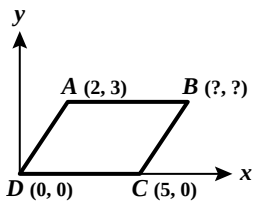
Instruction: Provide students an opportunity to identify quadrilaterals based upon their characteristic properties.

B. Standard of Learning: G.8.b The student will prove these properties of quadrilaterals using algebraic and coordinate as well as deductive proofs.

Builds On: Students begin studying the characteristics of quadrilaterals in the grade 1 SOL continuing in complexity through the grade 8 SOL.

B

25



If *ABCD* is a parallelogram, what are the coordinates of *B*?

A (3, 7)
B (5, 5)
C (7, 8)
D (7, 3)

Instruction: Provide students an opportunity to determine the coordinates of the fourth vertex of a quadrilateral when the coordinates are variables.

Geometry

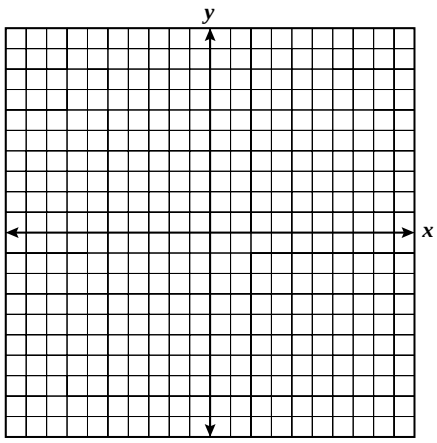
End of Course

A. Standard of Learning: G.8.c The student will use properties of quadrilaterals to solve practical problems.

Builds On: Students begin studying the characteristics of quadrilaterals in the grade 1 SOL continuing in complexity through the grade 8 SOL.

A

26 Three vertices of a square have coordinates (5, 1), (2, $^{-}$2), and ($^{-}$1, 1). You may want to plot the points on this grid.



What are the coordinates of the fourth vertex?

F ($^{-}$2, 2)
G (2, $^{-}$2)
H (2, 4)
J (4, 2)

Instruction: Provide students an opportunity to apply the properties of rectangles to solve problems.

Geometry

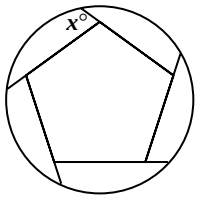
End of Course

A. Standard of Learning: G.9 The student will use measures of interior and exterior angles of polygons to solve problems. Tessellations and tiling problems will be used to make connections to art, construction, and nature.

Builds On: Students begin studying interior and exterior angles and tessellation in the Kindergarten SOL increasing in complexity through the grade 8 SOL.

A

27



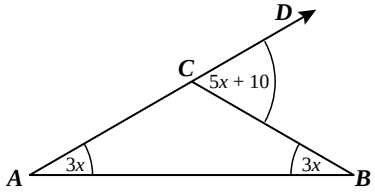
A floor tile is designed with a regular pentagon in the center of the tile with its sides extended. What is the value of x?

A 72°
B 90°
C 110°
D 120°

28 **Each exterior angle of a certain regular polygon measures 30°. How many sides does the polygon have?**

F 6
G 9
H 10
J 12

29 **The figure has angle measures as shown.**



What is the measure of $\angle BCD$?

A 120°
B 80°
C 60°
D 30°

Instruction: Provide students an opportunity to apply knowledge of the interior angles and exterior angles of a regular polygon and triangle; and to find a missing angle of a triangle, where the given angles are algebraic expressions.

Geometry

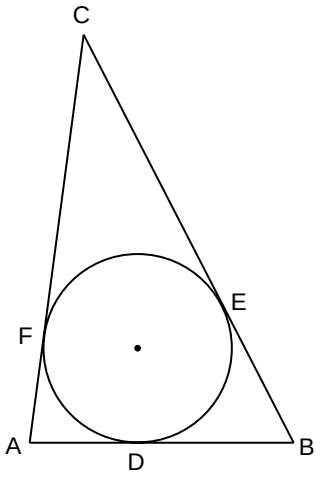
End of Course

A. Standard of Learning: G.10 The student will investigate and use the properties of angles, arcs, chords, tangents, and secants to solve problems involving circles. Problems will include finding the area of a sector and applications of architecture, art, and construction.

Builds On: Students begin to study circles in the Kindergarten SOL continuing in more complexity through the grade 8 SOL.

A

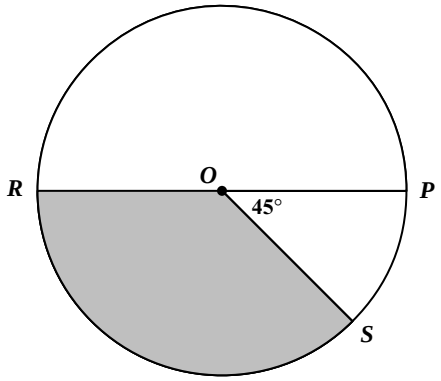
30 **The logo of an airline is a circle inscribed in a triangle.**



If *AF* = 3 and *AB* = 11, then *BD* = ___?

F 8
G 10
H 11
J 12

31



A circle for a game spinner is divided into 3 regions as shown. $\overline{RP}$ is a diameter. What is the area of the shaded sector *ROS* if *RP* = 8?

A 1.5 π
B 6 π
C 24 π
D 72 π

Instruction: Provide students an opportunity to calculate the area of a sector of a circle and use the relationship between tangent and secant to solve problems.

Geometry

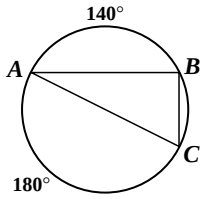
End of Course

A. Standard of Learning: G.10 The student will investigate and use the properties of angles, arcs, chords, tangents, and secants to solve problems involving circles. Problems will include finding the area of a sector and applications of architecture, art, and construction.

Builds On: Students begin to study circles in the Kindergarten SOL continuing in more complexity through the grade 8 SOL.

A

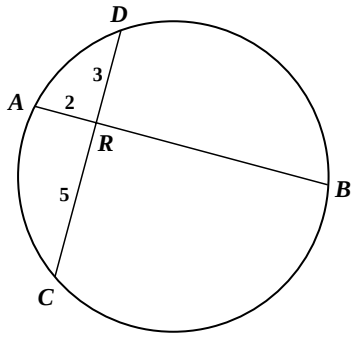
32



When inscribed in a certain circle, ΔABC intercepts arcs as shown in the diagram. What is the measure of $\angle BAC$?

F 90°
G 70°
H 40°
J 20°

33



Chords $\overline{AB}$ and $\overline{CD}$ intersect at R. Using the values shown in the diagram, what is the measure of $\overline{RB}$?

A 6
B 7.5
C 8
D 9.5

Instruction: Provide students an opportunity to apply knowledge of inscribed angles to find arc-angle values and use knowledge of chords intersecting within a circle to solve problems.

Geometry

End of Course

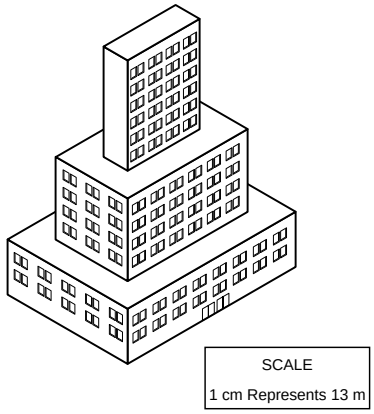
Reporting Category: Three-Dimensional Figures

A. Standard of Learning: G.12 The student will make a model of a three-dimensional figure from a two-dimensional drawing and make a two-dimensional representation of a three-dimensional object. Models and representations will include scale drawings, perspective drawings, blueprints, or computer simulations.

Builds On: Students begin work with three-dimensional figures in the grade 2 SOL increasing in complexity through the grade 8 SOL.

A

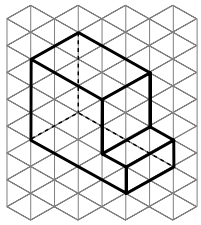
34



This is a scale drawing of a building. What is the actual height of the building?

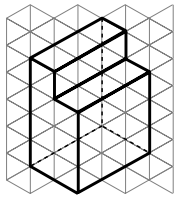
F 58.5 m
G 71.5 m
H 78 m
J 84.5 m

35 This is one view of a 3-dimensional object.

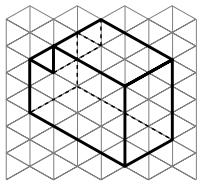


Which is a different view of the same object?

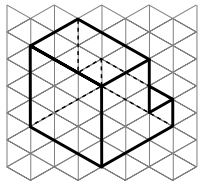
A



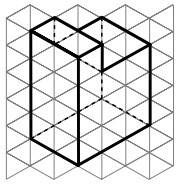
B



C



D



Instruction: Provide students an opportunity to make measurements on a three-dimensional figure whose lateral sides are in stepped planes, and recognize a correct different view of a given three-dimensional figure.

Geometry

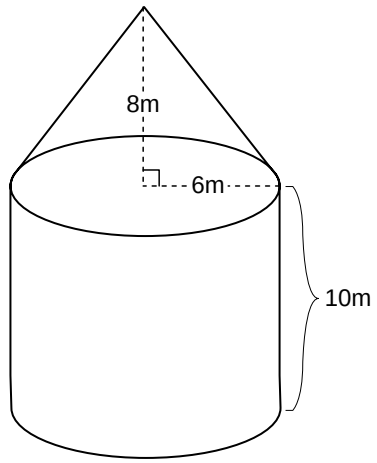
End of Course

A. Standard of Learning: G.13 The student will use formulas for surface area and volume of three-dimensional objects to solve practical problems. Calculators will be used to find decimal approximations for results.

Builds On: Students begin studying volume in the grade 1 SOL and surface area in the grade 2 SOL, increasing in complexity through the grade 8 SOL.

A

36



Rounded to the nearest hundred cubic meters, what is the total capacity (cone and cylinder) of the storage container?

F 1,400
G 2,000
H 5,700
J 8,100

37 What is the volume in cubic feet of a refrigerator whose interior is 4.5 feet tall, 2.5 feet wide, and 2 feet deep?

A 15 cu ft
B 19 cu ft
C 22.5 cu ft
D 25 cu ft

Instruction: Provide students an opportunity to apply skills for finding the combined volume of two geometric shapes and calculate the value of a rectangular volume.

Geometry

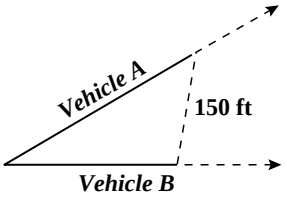
End of Course

A. Standard of Learning: G.14 The student, given similar geometric objects, will use proportional reasoning to solve practical problems; investigate relationships between linear, square, and cubic measures; and describe how changes in one of the measures of the object affect the others.

Builds On: Students begin to study similarity in the grade 7 SOL and continue through the grade 8 SOL.

A

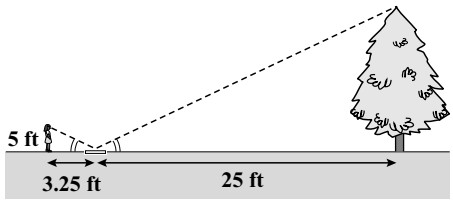
38 Two vehicles, each moving from a point in a straight line away from each other at an angle, are 150 feet apart after 6 seconds. Both are moving at a constant rate, vehicle *A* at 50 feet per second and vehicle *B* at 40 feet per second.



How far apart are they after 15 seconds?

F 150 ft
G 375 ft
H 600 ft
J 750 ft

39 In order to determine the height of a tree, María places a mirror flat on the ground 25 feet from the base. After backing 3.25 feet, she can just see the top of the tree in the mirror.



María knows that her eyes are exactly 5 feet above ground level and that the angle between her eyes, the mirror, and the ground is the same as the angle between the tree top, the mirror, and the ground. Which is closest to the height of the tree?

A 24 ft
B 28 ft 4 in.
C 38 ft 6 in.
D 40 ft

Instruction: Provide students an opportunity to apply knowledge of proportional reasoning to find the missing side of a triangle.

Geometry

End of Course

Reporting Category: Coordinate Relations, Transformations, and Vectors

A. Standard of Learning: G.2.a The student will use pictorial representations, including computer software and coordinate methods to solve problems involving symmetry and transformation. This will include using formulas for finding distance, midpoint, and slope.

Builds On: Students begin the study of the coordinate plane in the grade 5 SOL.

A

40 A circle whose center is at (1, $^-$3) passes through (7, 5). What is the length of the radius of the circle?

F 10
G $\sqrt{40}$
H $\sqrt{68}$
J 14

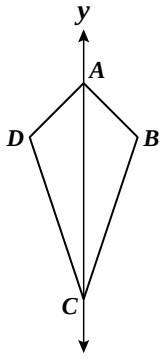
Instruction: Provide students an opportunity to find the length of a line, given two points on the line.

B. Standard of Learning: G.2.b The student will use pictorial representations, including computer software and coordinate methods to solve problems involving symmetry and transformation. This will include investigating and determining whether a figure is symmetric with respect to a line or a point.

Builds On: Students begin the study of symmetry in the grade 2 SOL.

B

41



Quadrilateral *ABCD* is symmetric with respect to the *y* axis. If the coordinates of *B* are (2, 1), what are the coordinates of *D*?

A ($^-$2, $^-$1)
B ($^-$1, $^-$2)
C ($^-$2, 1)
D ($^-$1, 2)

Instruction: Provide students an opportunity to determine the coordinates for a point of symmetry on a graph.

Geometry

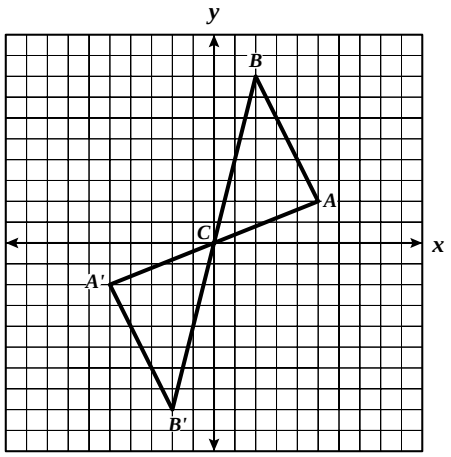
End of Course

A. Standard of Learning: G.2.c The student will use pictorial representations, including computer software and coordinate methods to solve problems involving symmetry and transformation. This will include determining whether a figure has been translated, reflected, or rotated.

Builds On: Students begin the study of transformations in the grade 8 SOL.

A

42



Triangle *A′B′C* is —

F a translation of triangle *ABC* across the *y*-axis

G a 180° rotation of triangle *ABC* about the origin

H a reflection of triangle *ABC* across the *y*-axis only

J a reflection of triangle *ABC* across the *x*-axis only

Instruction: Provide students an opportunity to determine the method of transformation for a given displacement on a graph.

Geometry

End of Course

A. Standard of Learning: G.15.b The student will solve practical problems using a system of vectors.
Builds On: Students begin to study matrices in the grade 8 SOL.

A

43 **If $\overrightarrow{RS} = (3, -2)$ and $\overrightarrow{TV} = (-1, -4)$, which column matrix shows the resultant $\overrightarrow{RS} + \overrightarrow{TV}$?**

A $\begin{bmatrix} 2 \\ -6 \end{bmatrix}$

B $\begin{bmatrix} 4 \\ 2 \end{bmatrix}$

C $\begin{bmatrix} -4 \\ -2 \end{bmatrix}$

D $\begin{bmatrix} -6 \\ 2 \end{bmatrix}$

44 $\overrightarrow{AB} = (4, -3)$
$\overrightarrow{BC} = (2, 4)$
$\overrightarrow{CD} = (-1, 1)$

Which matrix gives the resultant $\overrightarrow{AD}$ of the vector sum $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD}$?

F $\begin{bmatrix} 5 \\ 2 \end{bmatrix}$

G $\begin{bmatrix} 3 \\ -2 \end{bmatrix}$

H $\begin{bmatrix} 5 \\ 8 \end{bmatrix}$

J $\begin{bmatrix} -5 \\ 4 \end{bmatrix}$

Instruction: Provide students an opportunity to determine the resultant vector in column matrix form when given a sequence of vectors.

B. Standard of Learning: G.15.b The student will solve practical problems using a system of vectors.
Builds On: Students begin to study matrices in the grade 8 SOL.

B

45 **Joan drives 3 miles north, turns east for 2 miles, then north again for 4 miles, and finally 5 miles east. Which vector could be used to describe the resultant of her drive?**

A (5, 9)
B (5, 10)
C (7, 7)
D (7, 10)

Instruction: Provide students an opportunity to determine a resultant vector when given a sequence of individual vectors.

End of Course

Correct Answers

Geometry Test

1. A **2.** H **3.** B **4.** H **5.** C **6.** F **7.** D **8.** H **9.** D **10.** H
11. B **12.** G **13.** C **14.** G **15.** A **16.** F **17.** D **18.** F **19.** C
20. J **21.** C **22.** H **23.** C **24.** J **25.** D **26.** H **27.** A
28. J **29.** C **30.** F **31.** B **32.** J **33.** B **34.** F **35.** D **36.** F
37. C **38.** G **39.** C **40.** F **41.** C **42.** G **43.** A **44.** F **45.** C